Twin Stabilised D.C. Supplies PP3 & PP3R

Instruction Manual

Advance

RACAL RESEARCH LIMITED

Twin Stabilised D.C. Supplies PP3 & PP3R

Instruction Manual

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1 Introduction

The Twin Stabilised D.C. Supply PP3 is a portable instrument providing two independent and floating stabilised d.c. supplies, each variable from 0 to 30V at 1A maximum. The two supplies can be used separately, or connected in series to provide a maximum output of 60V at 1A.

In both sections of the instrument, the range is covered in three overlapping nominal 10V steps, with fine adjustment provided by a variable control directly calibrated in volts. A voltmeter and a dual-range ammeter are provided, and these can be switched independently to monitor either section.

Both sections are provided with four terminal output networks which virtually eliminate the effect of resistance in the connecting leads to the load.

Overload protection is effected by an electronic circuit which affords complete protection against both progressive and sudden short circuit overloads. This circuit is reset from the front panel by operation of the ON/OFF switch.

The instrument will operate from a.c. supplies of 90 to 130V and 200 to 240V. Fuses are provided to protect against both supply surges and internal component failure. The Twin Stabilised D.C. Supply PP3R is a 19-inch rack mounting version of the PP3. The specification is identical to the PP3 but the PP3R has the additional facility of the output being available on a 10-way terminal block at the rear of the instrument.

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2 Specification

Power Requirements The instrument operates from an a.c. supply of 90 to 130V, or 200 to 240V, at 40 to 60c/s.

Performance (each unit) OUTPUT VOLTAGE 0 to 30V d.c. in three overlapping ranges, 0 to 10V, 10 to 20V and 20 to 30V.

OUTPUT CURRENT 0 to 1A.

OUTPUT IMPEDANCE d.c.—less than 0·01 ohms. a.c. (up to 100kc/s)—less than 0·2 ohms.

RIPPLE Less than 0·5mV peak-to-peak.

STABILISATION Allowable supply variation from nominal value is ±7% before loss of stabilisation or component overloading occurs. Change of output voltages due to supply input variation of ±7% is approximately 10mV.

Metering Two meters are fitted: an ammeter which can be switched to either supply, ranges 0 to 1A and 0 to 0·1A F.S.D.; a voltmeter which can be switched to read either output voltage with an accuracy of ±2%.

Voltage Calibration The coarse and fine voltage setting controls are calibrated to an accuracy of approximately 0·2V, using external meters.

Overload Protection Provided by electronic cut-outs which can be reset from the front panel.

Operating Temperature The instrument can operate at full load in ambient temperatures up to 35°C.

Dimensions PP3 Width 18in., depth 11½in., height 13¼in. (46 × 29 × 34cm).

Dimensions PP3R Width 19in., height 12¼in., depth 9½in. behind panel and 1¾in. projecting in front of panel (48·25 × 31 × [24 + 3·5]cm).

Weight 38lb (17kg).

Finish PP3 Dark blue metal case with light grey front panel and medium grey surround. All colours to B.S.2660. Case tint No. 7–086, front panel tint No. 9–093, front panel surround tint No. 9–095.

PP3R Panel and protection cover dark admiralty grey to B.S.381.C, tint No. 632.

3 Operating Instructions

Warning

This instrument uses transistors, and for this reason it should not be operated in ambient temperatures in excess of 35°C (95°F), or under conditions which limit free circulation of air through the ventilation panels.

3.1 Preparations for use

Remove the rectangular plate that covers the a.c. supply socket at the rear of the case, and ensure that the supply voltage adjustment panel is correctly set for the local supply, and that the correct fuse is fitted. Alternative fuses are provided, a 3A fuse for use when the instrument is operated from a 200 to 240V supply, and a 5A fuse for operation from a 90 to 130V supply. The fuse not in use is carried in a clip next to the supply socket. Switch the ammeter selector switch to one of the 1A ranges, and connect the load or loads to the OUTPUT terminals. The two sections of the instrument can be connected in series if more than 30V is required, but under no circumstances should the two sections be connected in parallel.

Connect the instrument to the a.c. supply, set the output voltage controls to the required setting, and switch ON.

3.2 Metering

The ammeter and voltmeter can be switched independently to monitor each section of the instrument. When the two supplies are used in series, the output voltage is indicated by the sum of the two voltmeter readings.

3.3 Overload

The overload circuit will operate when the load current exceeds approximately 1·4A. To reset, switch the supply switch to OFF, wait three seconds, and then switch ON again.

It should be noted that the connection of a capacitive load to the output terminals, while the instrument is operating, can cause the cut-out to operate due to the initial surge current.

3.4 Four Terminal Network

The four terminal network is provided to keep the voltage across the load constant irrespective of voltage drop occurring along the d.c. supply leads.

To make use of this facility, use two further leads of any convenient gauge to connect each end of the actual load to the appropriate POTENTIAL terminals.

3.5 Fuses

The a.c. input circuit includes a single fuse, the rating of which is chosen according to the supply voltage. In the lower voltage range, 90 to 130V, the fuse rating is 5A, for the higher voltage range, 200 to 240V, the fuse rating is 3A.

The internal circuits are protected by two 3A fuses.

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4 Circuit Description

4.1 General

The two sections of the PP3 are identical, and the circuit diagram in *fig. 2* shows only one section complete.

The a.c. input is applied to the transformer (T1) primary winding via sections A and B of the ON/OFF switch, the fuse FS1 and the supply voltage tapping panel. The supply transformer has one high voltage and one low voltage secondary winding for each section, the low voltage winding being tapped to provide three output voltage ranges. To prevent switching surges, resistors R1 and R2 are switched into circuit momentarily as the range switch is operated.

A selenium bridge rectifier, MR1, rectifies the output from the low-voltage winding, and the resulting d.c. is smoothed by the 2500μF capacitor C1 and fed to the output terminals via the series regulator transistor TR2. One section of the current switch S4, inserted in the line to the negative output terminal, is used to switch the internal ammeter into circuit when required. The voltmeter is connected across the output terminals by means of switches S3A and S3B.

A bleed resistor R4 is permanently connected across C1, the smoothing capacitor, and this is paralleled by a 10ohm resistor R5 when the unit is switched off. R29 is a further bleed resistor connected across C6 and any capacity in the load circuit to provide a discharge path independent of the series regulator TR2.

4.2 Stabilising Circuit

The output from the high voltage secondary winding of T1 is rectified by the selenium bridge rectifier MR2, smoothed by an RC filter C2, R3 and C3, and used to provide a reference voltage via two cascaded neon stabilisers V1 (150V) and V2 (85V).

A potential divider network, RV2 to RV1, is connected across the neon stabiliser V2, via the 1ohm resistor R27. The voltage at the wiper of RV4, the front panel voltage control, is compared with the potential across the output terminals by means of a differential amplifier, the long-tailed pair TR4 and TR5. Sections A and B of switch S2 adjust the potential divider ratios as each output voltage range is selected. The preset controls in the divider network are included to permit accurate calibration of the voltage ranges.

Any output from the differential amplifier is current-amplified by two emitter follower stages TR3 and TR1, and applied as a correction signal to the base of the series regulator TR2. The effective impedance of TR2 is thus adjusted until the output and reference voltages are equal.

A four-terminal output network is provided, and when this is in use the POTENTIAL terminals are connected independently to the load. The stabilising circuit thus controls the actual voltage across the load, virtually eliminating the effect of the resistance of the power supply leads.

The correct operating potentials for the transistor circuits, including the overload cut-out, are derived from the high voltage d.c. supply via the zener diodes MR5 and MR6.

4.3 Overload Cut-out

Transistors TR6 and TR7 constitute a bi-stable multivibrator circuit with TR6 normally conducting. When the output current from the section exceeds a predetermined value, the potential developed across the series resistor R23 triggers the multivibrator which then changes its state. TR7 now conducts and the potential developed across R26 is used to shut-off the differential amplifier, causing the section output voltage to fall to zero. The germanium diode MR4 is included in circuit to block signals from the differential amplifier which might otherwise trigger the multivibrator.

To reset the cut-out circuit it is only necessary to switch the unit OFF for a few seconds, and then switch ON again. The multivibrator will then be in its original state with TR6 conducting.

The selenium rectifier MR3 is connected across the output terminals to prevent the development of a reverse voltage when the cut-out operates. This provision is particularly necessary when the two supply sections are operated in series.

5 Maintenance

5.1 General

The PP3 is of robust construction, and employs semiconductors throughout, with the exception of the two neon stabilisers. A high level of reliability has been achieved and the instrument should operate indefinitely without requiring extensive maintenance. In cases of difficulty, it is recommended that the instrument is returned to the factory for attention.

To obtain access to the internal components, place the instrument face downwards on a flat surface, remove the four retaining screws in the back, and lift off the case. *Fig. 1* shows the location of the components on the chassis assembly.

To remove the control knobs, it is first necessary to remove the spring-loaded plastic section of each knob to expose the retaining screw. When replacing the knob ensure that the indentation on the top of the plastic section coincides with the cursor on the skirt.

Voltage calibration accuracy using the built-in voltmeter is ±2%. Increased accuracy can be obtained by using a suitable external meter connected directly across the voltmeter terminals.

5.2 Re-alignment of Voltage Calibration

To re-align the voltage calibration using internal or external meters, proceed as follows:—

1. Remove the instrument from the case, connect it to the a.c. supply, and switch on.
2. Set the voltmeter selector switch to the required section.
3. Set the range selector switch to the 0–10V position, and adjust the variable control to give a reading of exactly 1V on the voltmeter.
4. Check that the cursor on the variable control indicates '1'. If necessary, rotate the control knob on its spindle until the alignment is correct.
5. Switch to the 20–30V range and set the variable control to '10'. Adjust RV1, located near the valves on the main chassis, until the voltmeter indicates exactly 30V (accuracy ±2%, i.e. ±0·6V using internal meter).
6. Set the variable control to '0' and adjust RV2 (see *fig. 1*) with an insulated rod until the voltmeter indicates exactly 20V.
7. Repeat 5 and 6 until no further adjustment is necessary.
8. Switch to the 10–20V range, set the variable control to '10' and adjust RV5 until the meter indicates 20V (accuracy ±2%, i.e. ±0·4V using internal meter).
9. Set the variable control to '0' and adjust RV3 until the meter indicates 10V (accuracy ±2% i.e. ±0·2V using internal meter).
10. Repeat 8 and 9 until no further adjustment is necessary.
11. Switch to the 0–10V range, set the variable control to '10' and adjust RV6 until the meter indicates 10V. The voltage calibration should now be correct.

5.3 Adjustment of Overload Cut-out

To adjust the overload cut-out a multimeter, such as the Avometer model 7 or 8, and a variable resistor rated at 0 to 10 ohms (minimum) and 1·5A, will be required. To make the adjustment, proceed as follows:—

1. Remove the instrument from the case, and invert the chassis.
2. Set the slider of the appropriate section potentiometer RV7 (located at the front of the component board) to that end of the potentiometer track connected to the 10K resistor.
3. Set the multimeter to the 10A range and connect it in series with the load resistor across the output terminals of the supply. Set the load to maximum resistance and switch off the internal ammeter.
4. Set the output to 8V and switch on.
5. Adjust the load resistor until the multimeter indicates a current of 1·4A.
6. Move the slider of RV7 away from the 18K resistor end of its track until the output drops suddenly to zero.
7. Switch OFF, slightly increase the load resistance and then switch ON again.
8. Decrease the load resistance and check that the cut-out again operates at 1·4A. If the cut-out fails to operate at the correct level, re-adjust RV7 as necessary.

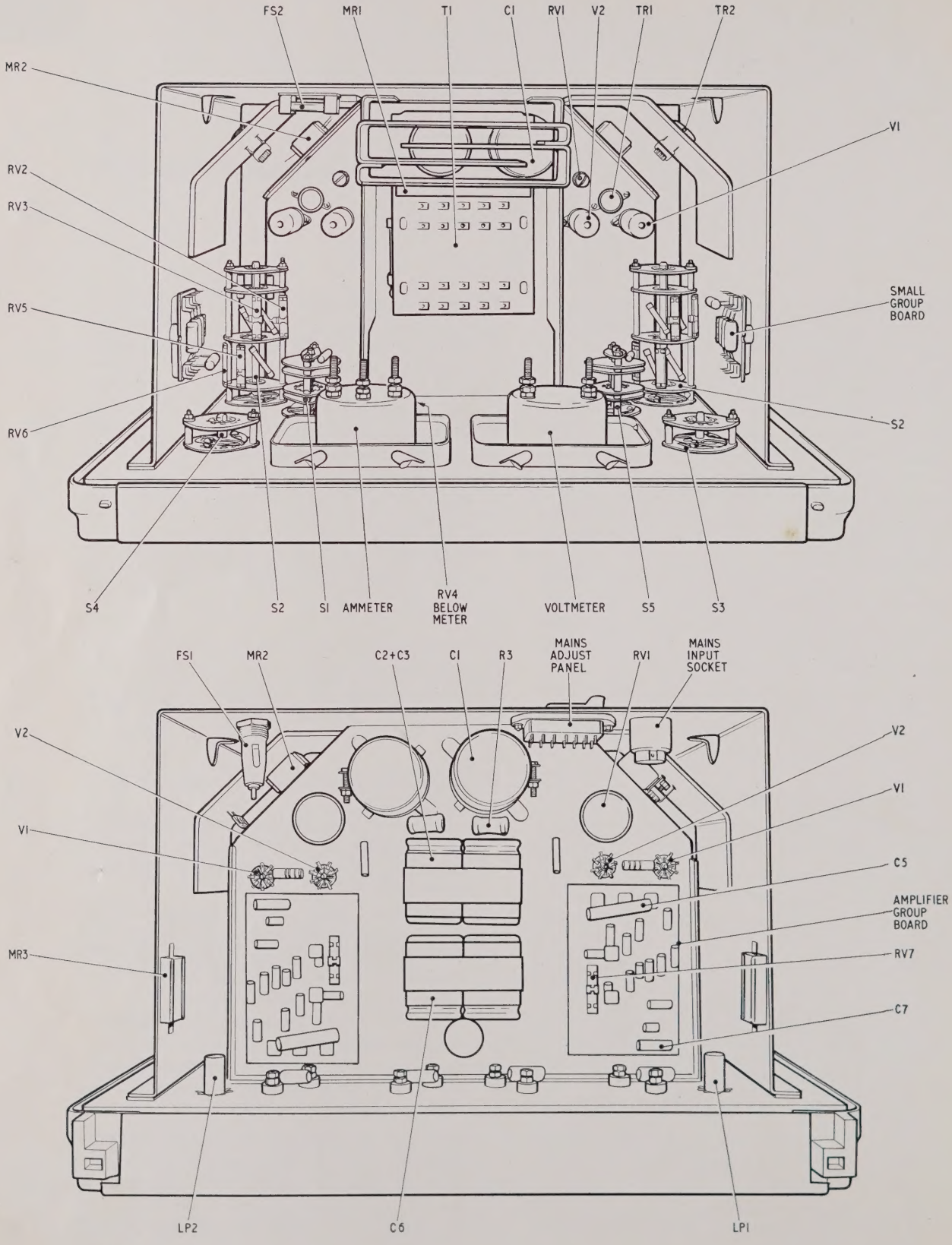
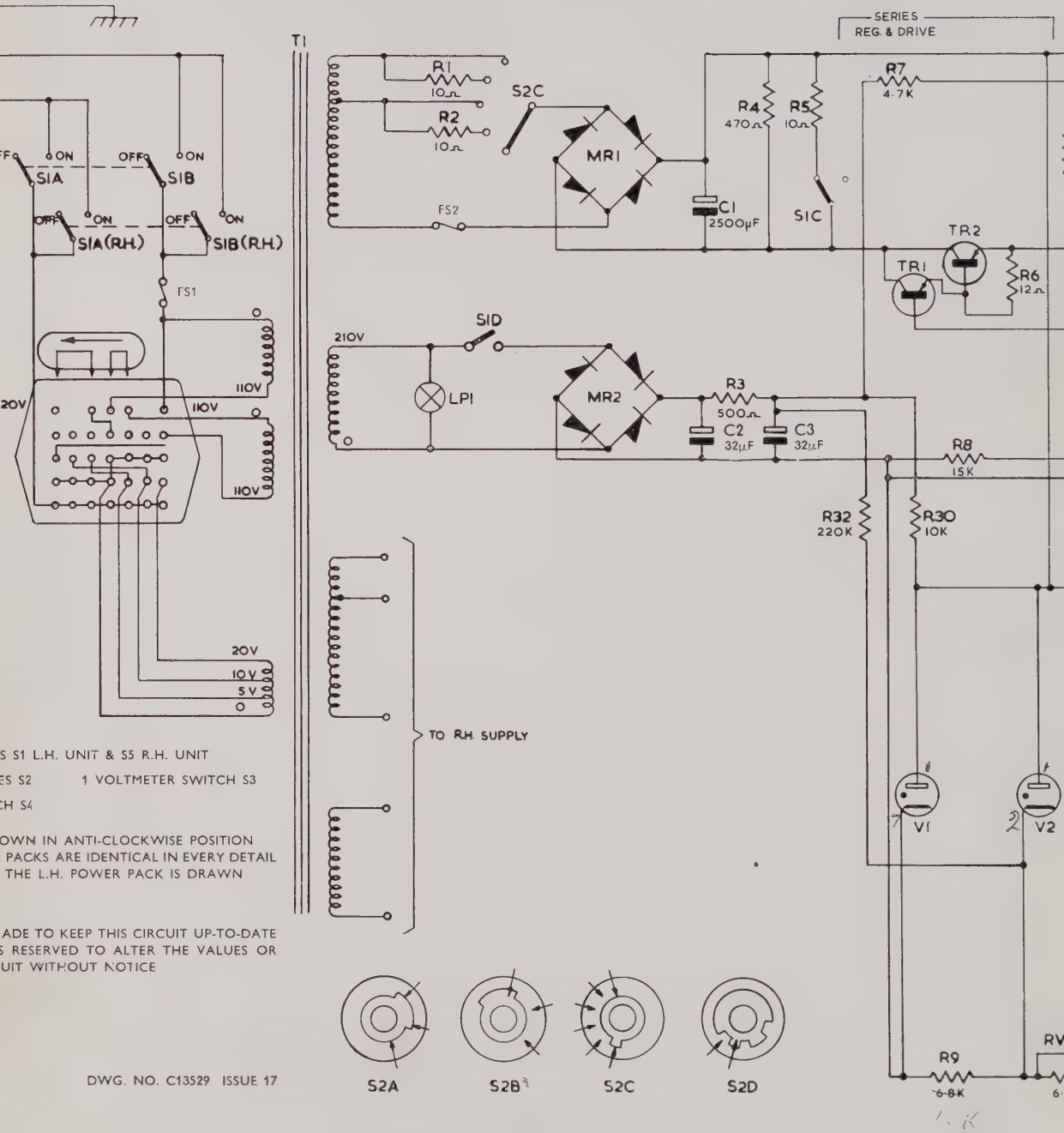


FIG. 1 COMPONENT LOCATION DIAGRAM



S S1 L.H. UNIT & S5 R.H. UNIT

ES S2 1 VOLTMETER SWITCH S3

CH S4

OWN IN ANTI-CLOCKWISE POSITION
PACKS ARE IDENTICAL IN EVERY DETAIL
THE L.H. POWER PACK IS DRAWN

ADE TO KEEP THIS CIRCUIT UP-TO-DATE
S RESERVED TO ALTER THE VALUES OR
UIT WITHOUT NOTICE

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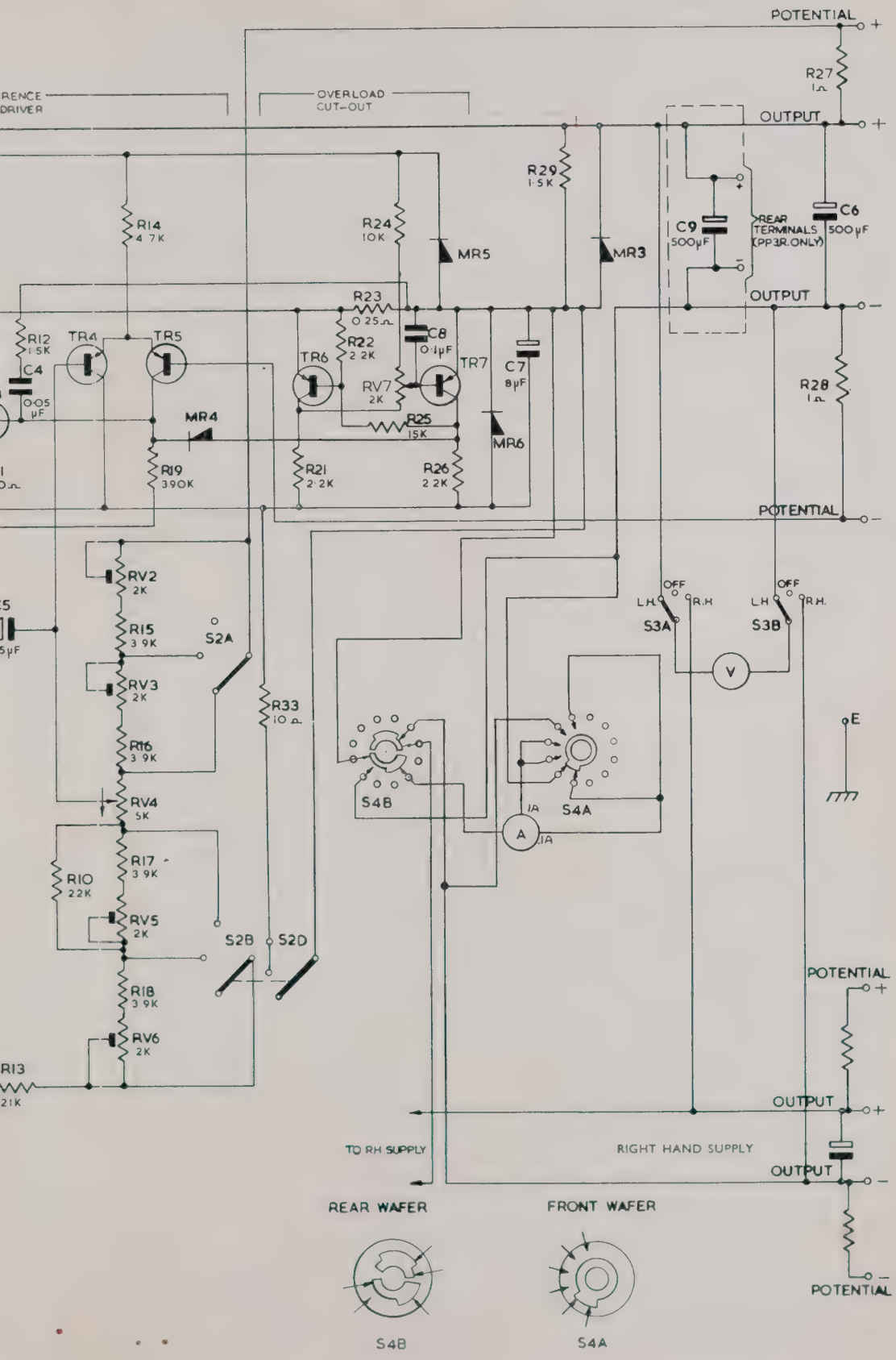

FIG. 2 CIRCUIT DIAGRAM PP3

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6 Components List

(One Section and Common Circuits only)

Resistors

Ref.	Description			Part No.
R1	10Ω	10%	RMA 8	140
R2	10Ω	10%	RMA 8	140
R3	500Ω	5%	3W, W.W. Dubilier A1	11248
R4	470Ω	5%	5W, W.W. RRC LG75	231
R5	10Ω	10%	RMA 8	140
R6	12Ω	10%	RMA 9	12826
R7	4·7K	5%	3W, W.W. RRC RWV4-J	138
R8	15K	5%	3W, W.W. RRC LG75	921
R9	6·8K	10%	RMA 8	10355
R10	22K	5%	RMA 9 ¼W	6963
R11	4·7K	10%	RMA 9	1499
R12	1·5K	10%	RMA 9	4405
R13	21K	1%	H.S. Welwyn C22	494
R14	4·7K	10%	RMA 9	1499
R15	3·9K	5%	RRC 2HS3	132
R16	3·9K	5%	RRC 2HS3	132
R17	3·9K	5%	RRC 2HS3	132
R18	3·9K	5%	RRC 2HS3	132
R19	390K	10%	RMA 9	7494
R20	Not used			
R21	2·2K	10%	RMA 9	867
R22	2·2K	10%	RMA 9	867
R23	0·25Ω		(31 S.W.G. Constantan)	
R24	10K	10%	RMA 9	671
R25	15K	10%	RMA 9	1177
R26	2·2K	10%	RMA 9	867
R27	1Ω	10%	3W, W.W. RRC RWV4-J	239
R28	1Ω	10%	3W, W.W. RRC RWV4-J	239
R29	1·5K	10%	RMA 8	11097
R30	10K	5%	3W, W.W. RRC LG75	381
R31	220Ω	10%	RMA 9 ¼W	1272
R32	220K	10%	RMA 9 ¼W	6703
R33	10Ω	10%	RMA 9	1903
RV1	6·8K	Preset Pot.	EGEN 126	230
RV2	2K	Preset Pot.	EGEN 196	131
RV3	2K	Preset Pot.	EGEN 196	131
RV4	5K	Pot. Colvern	CLR 3001.11	145
RV5	2K	Preset Pot.	EGEN 196	131
RV6	2K	Preset Pot.	EGEN 196	131
RV7	2K	Preset Pot.	EGEN 196	131

Capacitors

Ref.	Description		Part No.
C1	2500μF	50V D.C. WKG. Hunts L32/1	136
C2 } C3 }	32+32μF	350V. D.C. WKG. Hunts L32/3	135
C4	0·05μF	150V D.C. WKG. Hunts W99	7491
C5	25μF	50V D.C.WKG. Hunts JF102	10027
C6	500μF	70V D.C. WKG. Hunts S1928	427
C7	8μF	50V D.C. WKG. Plessey CE1250/1	476
C8	0·1μF	Hunts W48	325
C9	500μF	50V D.C. WKG. TCC CE26DE (PP3R only)	473

Transistors

TR1	V60/201P	Newmarket	137
TR2	OC.28	Mullard	148
TR3	OC.44	Mullard	338
TR4	OC.44	Mullard	338
TR5	OC.44	Mullard	338
TR6	OC.44	Mullard	338
TR7	OC.44	Mullard	338

Rectifiers

MR1	Selenium Rectifier	I.R.C. LiBi SBKD	1226
MR2	Selenium Rectifier	S & H B250/C75	12784
MR3	Selenium Rectifier	S & H B30/C600	334
MR4	Germanium Diode	Westinghouse WG5B	11538
MR5	Zener Diode	Z7 10% 6·8V	129
MR6	Zener Diode	Z5 10% 5·6V	128

Miscellaneous

V1	150C4	154
V2	GD83M	1460
S1	On/Off switch	13382
S2	Range switch	13386
S3	Voltmeter switch	13389
S4	Ammeter switch	13388
LP1	Indicator lamp	11077
FS1	Fuse 3A Bulgin F129	428
FS1	Alternative fuse 5A Belling Lee L1055	12807
FS2	Fuse 3A Bulgin F129	428
T1	Supply transformer	MT374
	Instruction Manual	245

2 MAINS SWITC

2 RANGE SWIT

1 AMMETER SW

ALL SWITCHES
R.H. & L.H. POV
THEREFORE ON

NOTE

EVERY EFFORT
BUT THE RIGH
AMEND THE C

7

7 Factory Service

Our Factory Service Department is at your disposal should you wish to obtain further repair information by telephone or letter. The Type and Serial Number of the instrument should always be quoted. We maintain an efficient service facility and the instrument can, if necessary, be returned to our factory for repair.

The instrument is guaranteed for a period of one year from its delivery to the purchaser for the replacement of defective parts, other than valves, semiconductors and fuses.

Valves and semiconductors are subject to the manufacturer's guarantee.

Equipment returned to us for servicing must be adequately packed, preferably in the special box supplied, and shipped with transportation charges prepaid. We can accept no responsibility for instruments arriving damaged. Should the cause of failure during the guarantee period be due to misuse or abuse of the instrument, or if the guarantee has expired, the repair will be charged and put in hand without delay unless other instructions are received.

OUR SALES, SERVICE AND ENGINEERING DEPARTMENTS ARE AT YOUR SERVICE AT ALL TIMES.

RACAL RESEARCH LIMITED